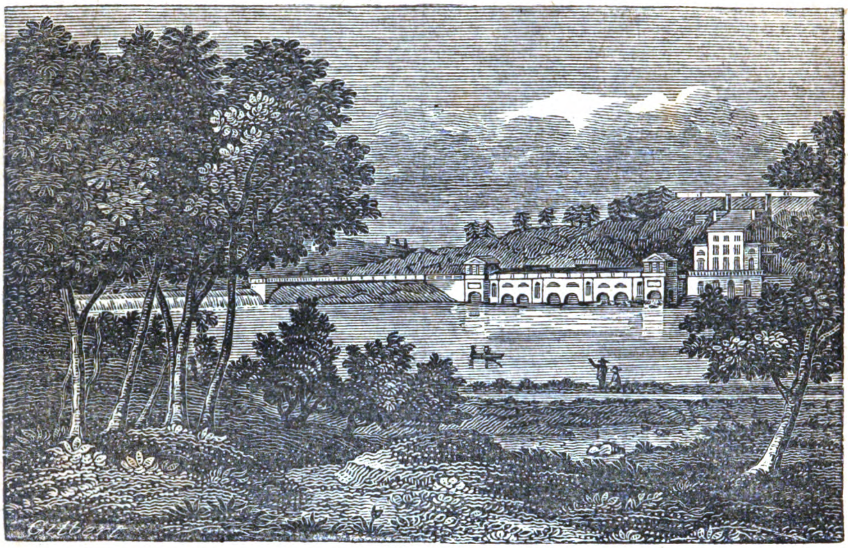
A View of Fair Mount Water Works,

IN THE VICINITY OF PHILADELPHIA.



The present number of the Casket is enriched with a view of the Philadelphia Water Works, on the Schuylkill. Among the many subjects of felicitation which our citizens possess in an eminent degree, none should be more highly esteemed than the Water Works, by which "health, safety and convenience," are most essentially promoted. Those who have resided in other cities in the Union, and especially at the eastward, in New York and Boston, can appreciate the blessings which we enjoy, of an abundance of fresh wholesome water, for every purpose of cleanliness or cooking—we have not lately been without it indeed—but the present mode by which it is obtained, is so economical, simple and effective, giving a profusion, without wasting the means, or adding to the expense, that its adoption is to be regarded as a new epoch in our City's history; nor are the advantages confined to the convenience of water for the City and Liberties, it is a fact that the beautiful scenery of the Schuylkill, has been much enriched by the establishment of the works in their present form—few places, we believe, in the vicinity of any city in the Union can vie with Fair Mount by moon light, in the richness of the neighbouring cultivated lands, the adjacent hills dotted with variously disposed habitations, the city in the rear, with its low hum of retiring business, and the beautiful stream below, the gush of the waterfalls, and the ripples tinged with the silvery beams of the moon, give Fair Mount a high claim to the attention of those who can appreciate such scenery, and find pleasure in the tranquil softness of an evening hour.

A full account of this great work is given in a report made by the Watering Committee to the Councils, on the 9th of January, 1823, from which the following extracts are made:—

"On the 19th of April, 1819, the work was commenced by Ariel Cooley, with whom a contract had been made for the erection of a dam, the locks and canal, the head arches to the race and the excavation of the race from a solid rock, for the sum of 150,000 dollars. This work is a monument to his memory; and he had nearly completed it, when he was taken off by a disease supposed to have been contracted by his exposure to the sun and night air, at the closing part of his work. His talents, his integrity, and his general worth, will long be held in grateful remembrance by the citizens of Philadelphia.

"It will be proper, in this stage of the report, to state the nature of the work that was to be accomplished, and to expose certain of its difficulties. The river is about nine hundred feet in width; one-fourth of which, at the bottom, on the eastern side, is supposed to be rock, covered with about eleven feet of mud; the remainder is of rock. The greatest depth is thirty feet at high water; and it gradually shoals to the western shore, where the rock is left bare at low tide. The river, whose average rise and fall is six feet, is subject to sudden and violent freshets.

"Mr. Cooley determined, where rock was to be found, to sink cribs, formed of logs, about fifty feet up and down stream, by seventeen or eighteen feet wide, which were sunk and filled with stone, and securely fastened to each other above low water, having the up-stream side planked from the bottom to the top, and the space immediately above filled to some extent with earth, small stones, and other matter, to prevent leakage. In that part where mud was found, the dam is made of quarry spalls and earth, and raised about fifteen feet higher than the other part of the dam, which is an over-fall of water; the base of this mount is at least one hundred and fifty feet, and its width on the top twelve feet; and the whole of the top, and of the up-stream side from the water edge, is paved to the depth of three feet with building stone, to prevent washing by water, and injury from ice. Between the mount dam and the over-fall, there is sunk, on the rock, in twenty-eight feet water, a stone pier, twenty-eight feet by twenty-three feet, which supports the end of the mound, and protects it from injury by ice or water. The contraction of the river by the mound dam, suggested to Mr. Cooley the idea of forming a dam in a diagonal line running up-stream, and when nearly over to run the rest of the distance at a right angle toward the shore, so as to join the head pier of the guard-lock on the western side, by which means a large over-fall was created, and the rise above the dam, in cases of a freshet, considerably abated. The whole length of the over-fall is 1202 feet; the mound dam, 270 feet; the head arches, which will presently be mentioned, 104 feet—making the whole extent of the dam, including the western pier, about 1600 feet, and backing the water up the river about six miles. The water power thus created is calculated to be equal to raise into the reservoir, by eight wheels and pumps, upwards of ten millions of gallons; the lowest estimate of the quantity of water afforded by the river in the dry season, is four hundred and forty millions of gallons per twenty-four hours, and as it is calculated, allowing for leakage, waste, &c. that forty gallons upon the wheel will raise one into the reservoir, the quantity raised would be eleven millions of gallons per day.

"On the west side of the river there are erected a head pier and guard-locks, whence there is a canal extending 569 feet to two chamber-locks, of six feet lift each, by which the boats ascend or descend; and below these locks there is a canal into the river, 420 feet long. The locks are built of dressed stone; the upper canal is walled on the east side, and on the west it is rock; the lower canal is formed of the stiff mud of the river, and covered with stone. The whole of the outer front of the locks and canal is protected by a wall on the upper part, and on the lower with stone thrown on the bank to prevent washing.

"On the east side of the river, the whole of the bank was a solid rock, which it was necessary to excavate to the width of 140 feet, to form a race, and a site for the mill-houses, running parallel with the river. The length of the mill-race is 419 feet; the greatest depth of the excavation, sixty feet, and the least sixteen feet; the gunpowder used, alone cost the contractor upwards of 12,000 dollars. At the upper part of this excavation are erected the head arches, three in number, which extend from the east end of the mound dam to the rock of the bank, thus forming a continuation of the dam.

"On the west of the excavation are erected the mill-houses, forming the west side of the race, which is supported on the other side by the rock rising above it seventy or eighty feet perpendicularly. The south end or wall of the race is also of solid rock, and the mill-houses are founded on rock, so that nothing can be contrived more secure in all respects.

"The race is about 90 feet in width, and is furnished with water through the head arches, which allow a passage of water of 68 feet in breadth, and 6 feet in depth, to which the race is excavated below the over-fall of the dam, and of course room is allowed for a continual passage of 408 square feet of water. These arches are on the north of the race, and the mill-buildings being on the west, the water passes from the race to the wheels, which discharge the water into the river below the dam. The gate of the centre arch is upon the principle of a lock-gate, and admits the passage of boats, &c. into the race; at the south end of the mill-buildings there is a waste-gate, eight feet wide, by which (the upper gates being shut) the water can be drawn off to the bottom of the race.

"The mill-buildings are of stone, 238 feet long, and 56 feet wide. The lower section is divided into twelve apartments, four of which are intended for eight double forcing-pumps. The other apartments are for the forebays leading to the water-wheels. The pump and forebay chambers are arched with brick, and are perfectly secure from the inclemency of the winter. Those now in use are kept warm by means of two large iron stoves, heated to great advantage and economy with Schuylkill and Lehigh coal. A gallery will be erected, extending the whole length of the building, from which all the wheels may be seen at one view. The centre part of the buildings is 190 feet by 25 feet, with circular doors to the pump-chambers, and a range of circular windows over the archways of the wheel-rooms. On a line with the cornice of the central part is the base course of two pavilions, with Doric porticoes, which terminate the west front. One of these is used for the office of the Committee, and the other is the residence of an old and faithful servant of the corporation, who has the general care of the property at Fair Mount. On the east front, immediately over the pumps and forebay rooms, is a terrace, 253 feet long, and twenty-six feet wide, paved with brick, and railed, forming a handsome walk along the race, and leading by steps at the end to the top of the head arches, mound dam, and pier."

It was not the intention of the Committee to erect more than three wheels and pumps for the present, which were completed in December, 1822. The first wheel is fifteen feet in diameter and fifteen feet long, working under one foot head and seven feet fall; this wheel raises 1¼ million of gallons of water to the reservoir, in twenty-four hours, with a stroke of the pump of 4½ feet, a diameter of 16 inches, and the wheel making 11½ revolutions in a minute. The second wheel is of the same length as the first, and 16 feet diameter: it works under one foot head and 7½ feet fall, making 13 revolutions in a minute, with a 4½ feet stroke of the pump, and raising 1⅓ millions of gallons in twenty-four hours. The third wheel is of the same size as the second, and works under the same head and fall, making 13 revolutions in a minute, with a 5 feet stroke of the pump, and raising 1½ million of gallons in twenty-four hours. The whole quantity thus raised is upwards of 4 millions of gallons in twenty-four hours. The wheels are formed of wood, the shafts of iron, weighing about five tons each.

"The pumps are the work of those ingenious engineers, Messrs. Rush and Muhlenberg. They are placed horizontally, according to a design of Mr. F. Graff, and are worked by a crank on the water-wheel, attached to a pitman connected with the piston at the end of the slides. They are fed under a natural head of water, from the forebays of the water-wheel, and are calculated for a six feet stroke: but hitherto it has been found more profitable to work with not more than five feet. They are double forcing pumps, and are connected, each of them, to an iron main of sixteen inches diameter, which is carried along the bottom of the race, to the rock at the foot of Fair Mount, and thence up the bank into the new reservoir. At the end of the pipe there is a stop-cock, which is closed when needful for any purpose. The shortest of these mains is 284 feet long: the other two are somewhat longer. The reservoir next the bank is 139 by 316 feet, is 12 feet deep, and contains 3 millions of gallons. It is connected at the bottom with the old reservoir, by two pipes of 20 inches diameter, with stop-cocks. This reservoir contains 4 millions of gallons. The water being raised into the reservoirs 102 feet above low tide, and 56 feet above the highest ground in the city, is thence conveyed to the city."

In a subsequent Report made to the Councils on the 8th of January, 1824, the Committee state some gratifying facts as to the quantity of water which experience has shown the wheels capable of raising:

"The experience of another year has furnished results that will probably be interesting to councils; and the Committee therefore trespass a little in detailing the beneficial effects produced by the new Water Works at Fair Mount, which have exceeded the warmest anticipations of their most sanguine friends. The calculations formed were of the most cautious kind, for there was little experience to guide in the construction of water works calculated to raise water, and hence it was stated that forty gallons upon the wheel would be required to raise one to the reservoir; but experience has shown that thirty are more than ample, thus at once increasing the calculation of the water power of the river one-third. The quantity raised was also underrated at one million of gallons in twenty-four hours, for each wheel and pump: it may now be safely stated at 1,250,000, supposing the wheel to work during the whole time, but this is not always the case, as the tide occasionally makes it prudent to stop them, to prevent straining the works.

"An experiment was made in July last for eighteen days, during which time four fire-plugs were constantly in use during the day-time in washing the gutters, when two wheels and pumps were found adequate to supply the demand, and working only fourteen hours in twenty-four; and the consumption of water was 1,616,160 gallons in the same period of twenty-four hours. In October last, the three wheels were found sufficient to supply the city in eight hours, equal to one wheel for twenty-four hours, and supplying 1,250,000 gallons.

"In the last month, the wheels were stopped three days on account of the water being disturbed by a freshet, during which time the reservoir fell fifty-two inches: after the water had settled, the three wheels were put in operation, and, besides supplying the city with about 1,250,000 gallons, they filled the reservoir in twenty-four hours, equal in all to 3,750,000 gallons. The demand of the city for water, in very cold weather, may be stated at about 1,000,000 of gallons.

"The advantage of the large reservoirs is particularly observable during a freshet in the river, as the city can be supplied for several days with clear water from them, whilst the muddy water is running off, during which time the wheels are of course stopped."

On the 24th of October, 1822, the steam-engines were stopped, and it is believed will never again be wanted. The strength of the dam was tested in the most satisfactory manner, in February, 1822, by an ice-freshet, which rose eight feet above the over-fall, and which is supposed to be the greatest ever known in the Schuylkill.

The whole cost to the city of the works at Fair Mount is as follows:—

Cost of the water power at the Falls	$ 150,000
Erection of the dam, locks, head-arches, race, and piers, including estimate of damages for overflowing by the dam	187,182

Three pumps	11,000
Mill-houses, mills, and other works connected with them .	71,250
Iron raising mains	4,480
New reservoir	8,600
	$ 432,512

The entire amount expended by the city of Philadelphia, on the successive operations for introducing the Schuylkill water, is shown by the following table:—

Cost of the first works on Centre Square, and Chesnut street near Schuylkill	$ 690,402 81
The second steam works, including the reservoir, cost .	320,669 84
The present water works cost	432,512 71
Total cost	$ 1,443,585 36

The advantage of water power over steam power for such works as these, is well shown in the Report of the watering Committee of 1823:—

"By an estimate made by Mr. Graff, and exhibited to the Councils, with the Report of the Committee on Water Power, on the 5th of February, 1818, it appeared that the cost of working one steam-engine and pump for one year was 30,858 dollars; and it has been found, that with this expenditure, not more than 1,600,000 gallons could be raised in twenty-four hours—a very inadequate supply for the population of the city, consisting of above sixty thousand souls; without a gallon being afforded to the adjoining districts containing an equal number, and for whom until the present period there was no provision except by means of wells. If, therefore, it were required, at the same rate of expense, to raise an equal quantity with that at present afforded by three wheels, the cost would be upwards of 70,000 dollars; but, estimating the cost at only double that of one engine, it will amount to 61,716 dollars. From this is to be deducted the interest on the capital expended in erecting the water power and works, which was 426,330 dollars, and was principally borrowed at an interest of five per cent, and amounts to 21,316 dollars annually, and also the expenses for wages, fuel, oil, &c. estimated at 1500 dollars annually, amounting together to 22,816 dollars, which being deducted from the sum of 61,617 dollars, leaves a clear annual saving of 38,900 dollars, equal, at an interest of five per cent, to a capital of 778,000 dollars.

"As before stated, it is not doubted that the water power is sufficient to work five wheels and pumps in addition to the three in operation, which would raise an additional quantity of more than six millions of gallons; and, estimating the saving of this quantity in the same ratio as before stated, the amount would be 103,000 dollars more, equal to a capital of upwards of two millions of dollars, and showing the whole saving or profit to be 142,000 dollars annually, a sum nearly double the amount of the city taxes, exclusive of interest on the city debt, which will soon melt away by the operation of the Sinking Fund."

In the Report of 1824, the comparative superiority of water power is again shown:—

"Two men are found sufficient to attend the works, twelve hours at a time alternately, night and day; and the calculation made last year, of four dollars per day, for wages, fuel, light, tallow, &c., is, upon experience, found to be ample. The plan of warming the house has completely answered the object proposed; and no ice has formed, in the coldest weather, on the wheels, or in the pumps.

"The whole cost of the new works, including the damages, the new reservoir. and the preparation for a third one, is 432,512 dollars, the interest on which, at the rates the money was borrowed, amounts to 24,230 dollars; a sum not much exceeding that formerly appropriated every year out of the city taxes for the support of the steam-engines, besides consuming the whole of the water-rents. The contrast is most pleasing, when it is seen that the water rents are so much disengaged, as to place in their treasury from their avails, upwards of 14,500 dollars, whilst the sums heretofore appropriated of the taxes for the steam-engines, go to meet the interest on the debt for the erection of the works.

"But this is not the whole advantage. It was not possible with the steam-engines, that a million and a quarter of gallons could be raised; now, three times that quantity can be had, without any increase of expense; but if the same quantity were required to be raised by additional steam-engines, the annual expense would be at least 75,000 dollars; or in other words, the expense, (exclusive of the first cost of the steam-engines and of the water works,) would be 206 dollars per day, to raise three millions and three quarters of gallons by steam, which is now done for four dollars per day, by water, with this further advantage, that with the expenditure of not more than 50,000 dollars for five new wheels and pumps, the quantity can be increased to ten millions of gallons in twenty-four hours, the water power being sufficient to raise more if required.

"An additional quantity of 6,750,000 gallons, raised by steam-engines, would cost 344 dollars per day, making the whole expense to raise ten millions of gallons by steam, 550 gallons per day, whilst the same quantity can be raised by water for 10 dollars per day, which includes the present expense, (before-mentioned,) of 4 dollars per day, and an allowance of six dollars for additional hands, fuel, tallow, &c.; without estimating the interest on the first cost of either species of engines and pumps."

Such are the means adopted to procure a sufficient supply of water in Philadelphia. The uses and importance of the water thus introduced, are stated in the Report of the Committee:—"The additional cleanliness of the city—the supply of the neighbouring districts, for culinary purposes, as well as for purposes of refreshment—the great advantage in cases of fire—the ornament of fountains in the public squares so wisely provided by our great founder—the benefit to manufactures, and the establishment of water power in the city for various purposes, may be named among the advantages of this new work; but above all we are to place its effects upon the health of a great and a growing community, which of itself would justify a much greater expenditure."

The water is conveyed from the reservoir through the city by means of pipes laid below the pavements. Until lately, wooden pipes were used for this purpose; but the inadequate supply of water derived through them, and the constant vexation and expense occasioned by their bursting, have caused the substitution of iron pipes, which, although considerably more expensive in the first cost, are in the result the most economical. The first appropriation for this purpose was a sum of 70,000 dollars, voted by the Councils, in December, 1818, for a main pipe of conduit, which was soon afterwards laid—viz. from the reservoir along the old canal bank to Callowhill street, of 22 inches diameter, 2661 feet; and thence to the intersection of Broad and Chesnut streets, 6909 feet. With this are connected the iron and wooden pipes for the supply of the city. A regular plan is pursuing of replacing the wooden with iron pipes; and at the present time, including the main, there are about nine miles of iron pipes laid: during the summer of the present year (1824) about four miles more will be put down. The whole extent of pipes now laid, of wood and iron, is about thirty-five miles. The cost of the iron pipes, to 1824, is as follows:—

Cost of 20 and 22 inch iron main	$ 72,947 23 cts.
Cost of iron pipes of smaller dimensions, to the 31st December, 1823 . . .	87,743 58
Estimate for 1824 . . .	42,040 32
Total	$ 202,731 13

At the outset of the undertaking, a number of pipes were imported from England as models, and another importation has since been made to supply the deficiency created by the failure of an American contractor; but at present the pipes are made in this country, as well and at as low a price as in England. Of the above sum of $202,731 13 cts, only $16,940 31 cts. have been expended on *imported* pipes.

To defray the expenses of these operations, taxes are annually laid, and a certain annual sum is paid by the occupier of each house in which the water is introduced. The annual rent paid for the use of the water in 1823, for the city alone, was $26,191 5 cts.; an excess of near 2000 dollars over the interest upon the cost of the water power works. When the water shall be introduced into the adjoining districts, which is expected to take place in a short time, the income of the corporation will be considerably augmented.

In 1823, the Schuylkill water was introduced by pipes into 3954 private dwellings, and 185 manufactories: 401 private baths were also supplied with it. The lowest sum annually paid by a private dwelling was two dollars, and the highest (by a public institution) 100 dollars.

The experience of two years has shown that the water power at Fair Mount is sufficient to raise many times as much water as the city can possibly require for its consumption, and consequently that there is a surplus power applicable to other purposes. It is not easy to determine what amount of power might be spared, but it is believed to be sufficient for a very considerable number of manufactories. For the purpose of assisting the funds of the corporation, and at the same time to give facilities to manufacturing industry, it is in contemplation to extend the race down along the Schuylkill below the bridge as far as may be necessary, and to erect mills and mill-works between the race and the river, for which there would be ample space. A considerable number of applications have already been made for the use of the water power: there is no doubt that all will be taken, and that the most beneficial consequences will result to the finances and trade of the city from the proposed plan.

THE HUMOURIST.

A NEW GENERAL.

When the accounts of the astonishing success of Bonaparte arrived in Italy, a young nobleman observed, that he had gained most of those advantages from the assistance of some new Generals he had created. "I know no General he has lately created," said George Colman, "but one—General Consternation."

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It is curious to remark, says Mr. Weddell, in the account of his late voyage towards the South Pole, that the sea elephant, when lying on the shore, and threatened with death, will often make no effort to escape into the water, but lie still and shed tears, only raising his head to look at the assailant, and though very timid, will wait with composure the club or lance which is to take his life. In close contact every human effort would be of little avail for the destruction of this animal, unwieldy as it is, were it to rush forward and exert the power of its jaws; for this, indeed, is so enormous, that, in the agony of death, stones are ground to powder within its teeth.